

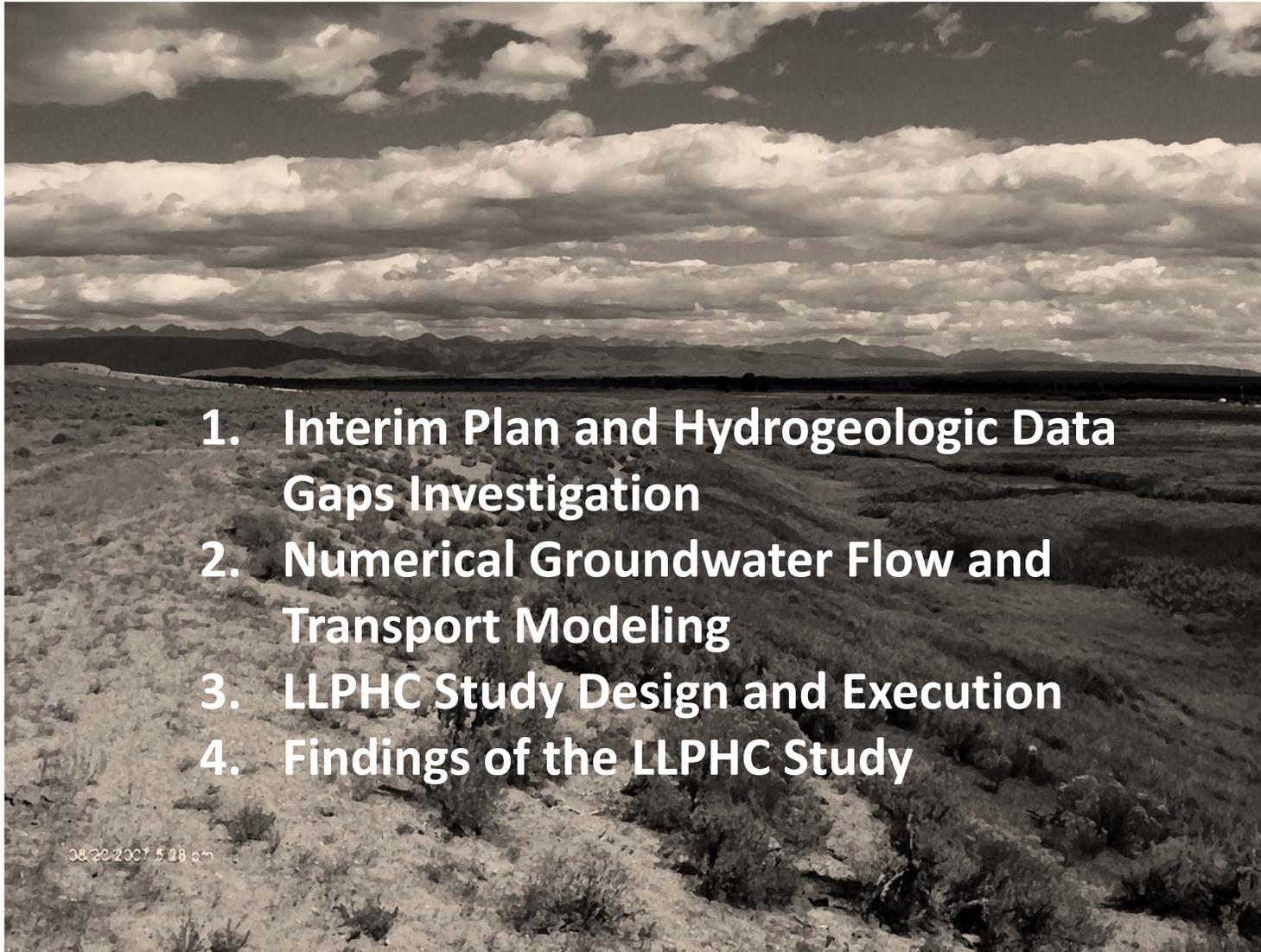


## Interim Plan

### Hydrogeologic Data Gaps Investigation

Pinedale Anticline Project Area ROD, Sublette County, Wyoming

# Today's Presentations – Interim Plan

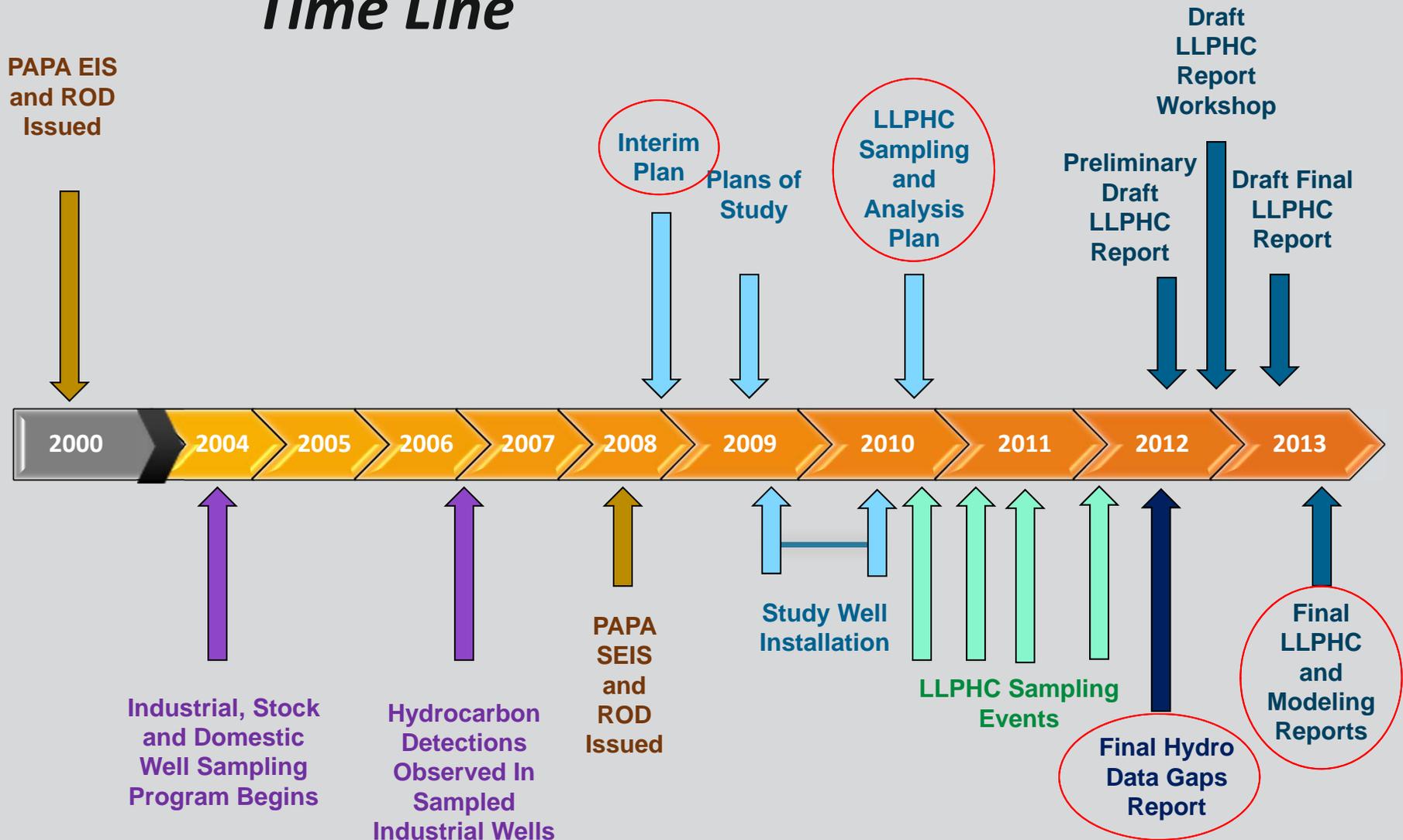


## Discovery 2006 - 2007

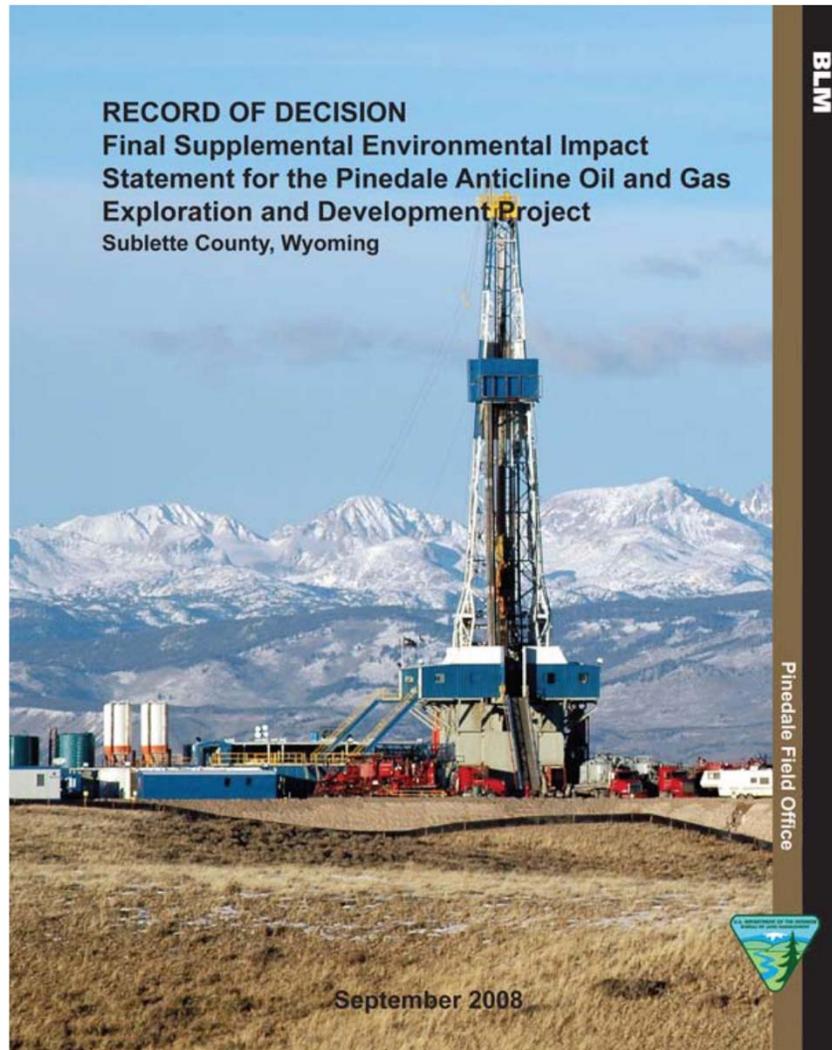
- Annual groundwater monitoring began in 2004
- 2006 detection of low-level petroleum hydrocarbons
- By early 2007 all WSW wells re-sampled
- Approximately 70+ samples exhibited low-level detections



# Time Line



# SEIS Decision – Groundwater Resources



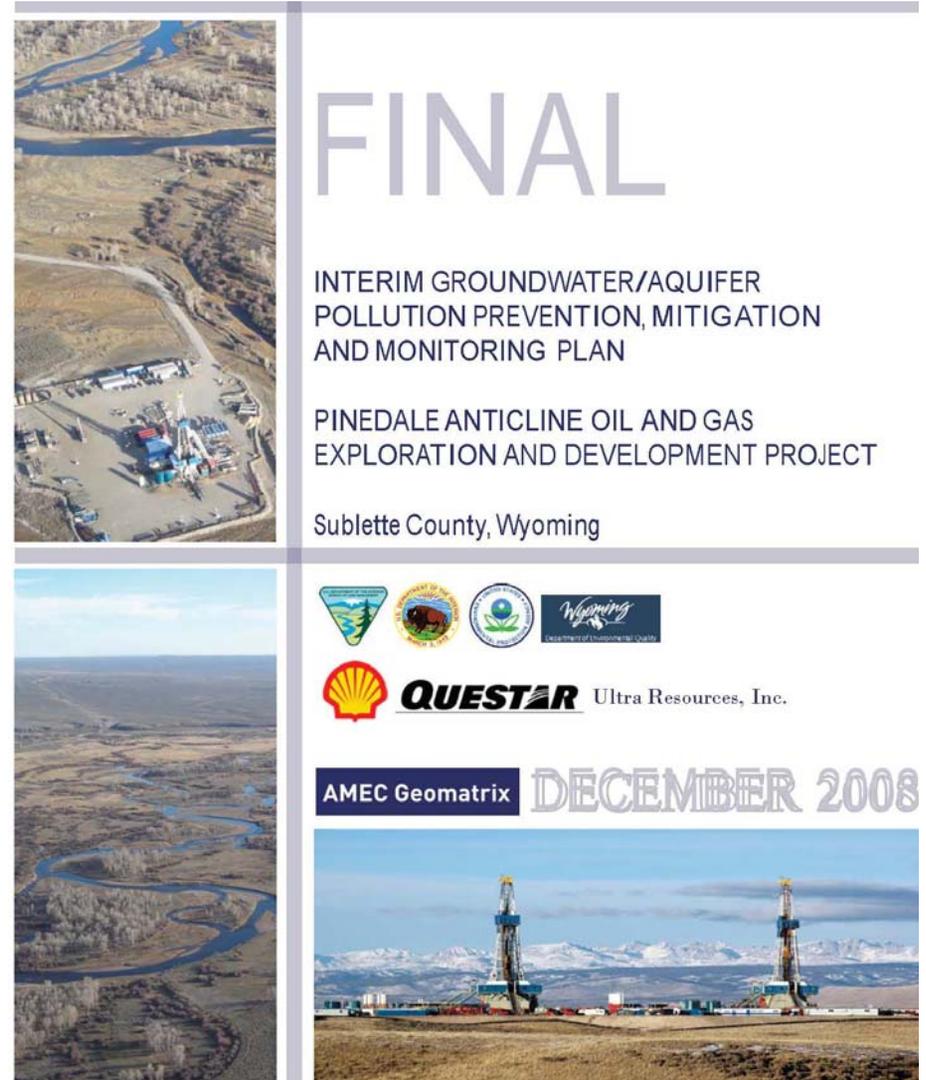
- ROD – Mitigation Measures for Groundwater Resources
- The Guide – BLM’s Regional Framework for Water Resources Monitoring Related to Energy Exploration and Development
- Three Steps
  - 1) Compile Existing Information
  - 2) **Develop and Implement Interim GW/APPMP**
  - 3) Finalize GW/APPMP

# Interim Plan – Three Tasks

1. **Characterize** the Groundwater System
2. **Augment** the Existing Monitoring Program
3. **Identify Mitigation** for all Potential Sources of Contamination

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## POLLUTION PREVENTION AND MITIGATION



The image shows the cover of a report titled "FINAL INTERIM GROUNDWATER/AQUIFER POLLUTION PREVENTION, MITIGATION AND MONITORING PLAN" for the "PINEDALE ANTICLINE OIL AND GAS EXPLORATION AND DEVELOPMENT PROJECT" in "Sublette County, Wyoming". The cover features two photographs: an aerial view of an industrial site and a landscape view of a winding river. Logos for the Wyoming Department of Environmental Quality, Shell, and Questar Ultra Resources, Inc. are present, along with the date "DECEMBER 2008" and the publisher "AMEC Geomatrix".

# Technical Team

## Every Step of the Way

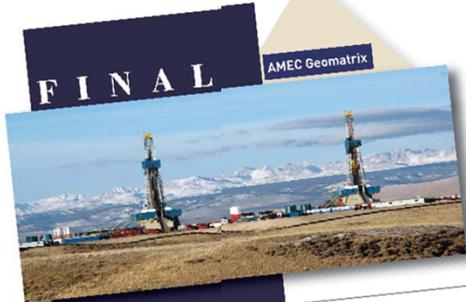
- ✓ Professional
- ✓ Cooperative
- ✓ Collaborative
- ✓ Determined
- ✓ Input
- ✓ Discuss/Debate/Decide
- ✓ Review – Comment (repeat)
- ✓ Accept

**Integral, Vested**

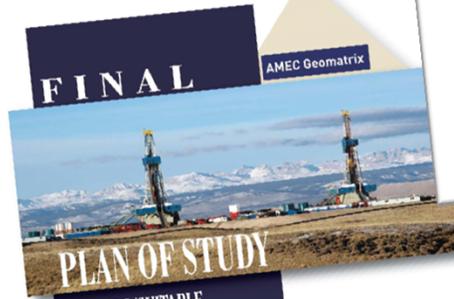
- BLM (State and Field Offices)
  - DEQ (State and Regional Offices)
  - EPA (Regional Office)
  - Ultra Resources
  - SWEPI LP (Shell)
  - QEP Energy
  - AMEC (Contractor)
  - NewFields (Contractor)
- } BDE
- } USQ

**Continual Involvement**

# Plans



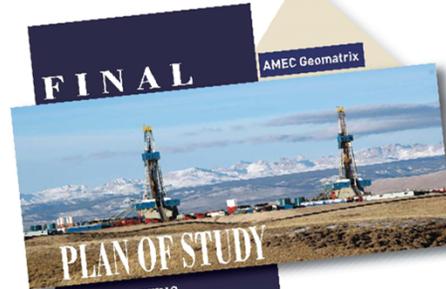
PROJECT  
ADMINISTRATION  
PLAN



PLAN OF STUDY

CREDIBLE/SUITABLE  
WELL  
DETERMINATION

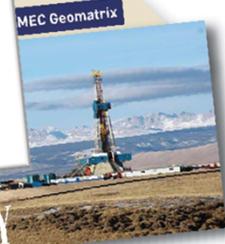
MAY 2009



PLAN OF STUDY

FOR EVALUATING  
POTENTIAL SOURCES  
OF LOW-LEVEL  
PETROLEUM HYDROCARBON  
COMPOUND  
DETECTIONS

MAY 2009



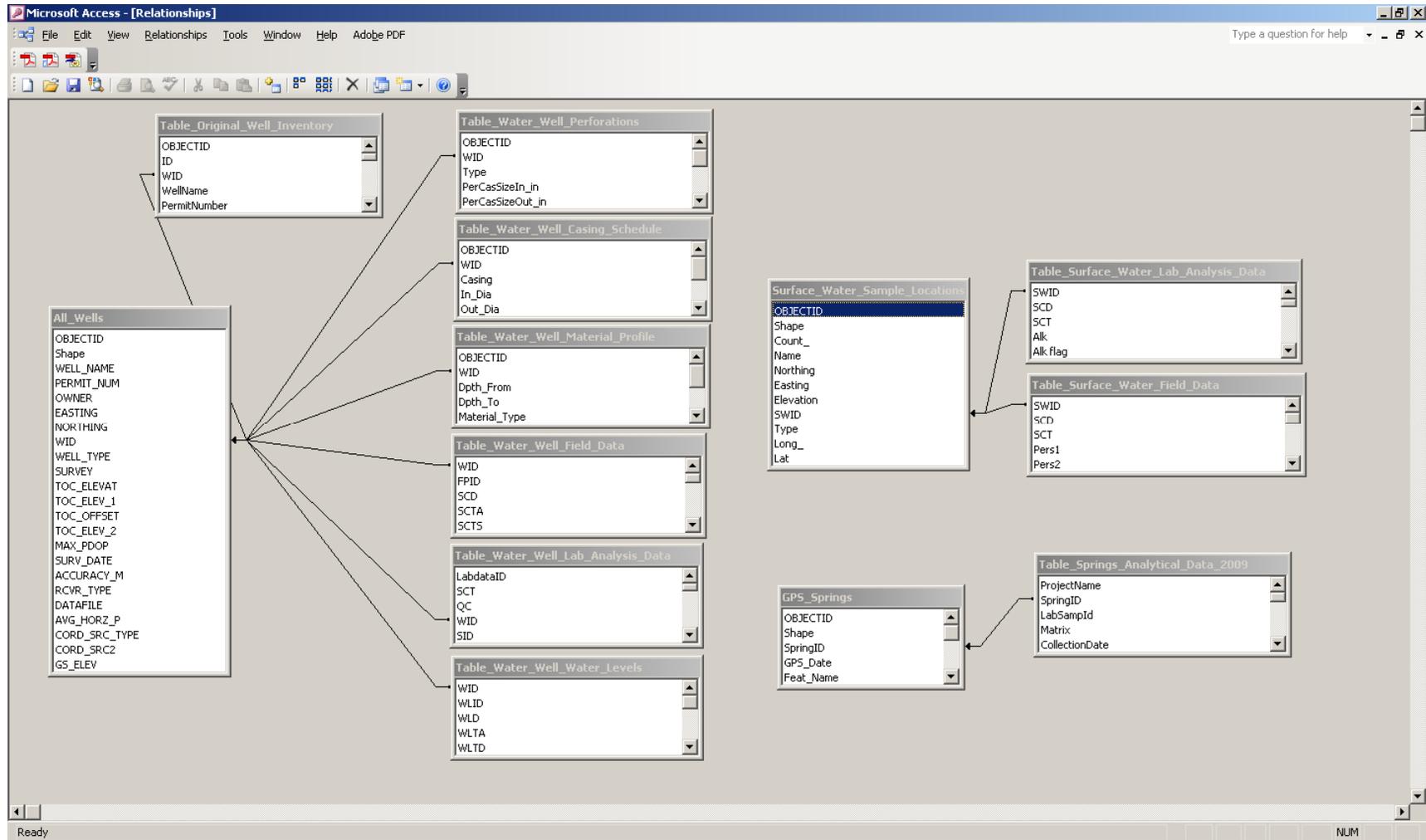
PLAN OF STUDY

HYDROGEOLOGIC  
DATA GAPS

MAY 2009



# Geodatabase



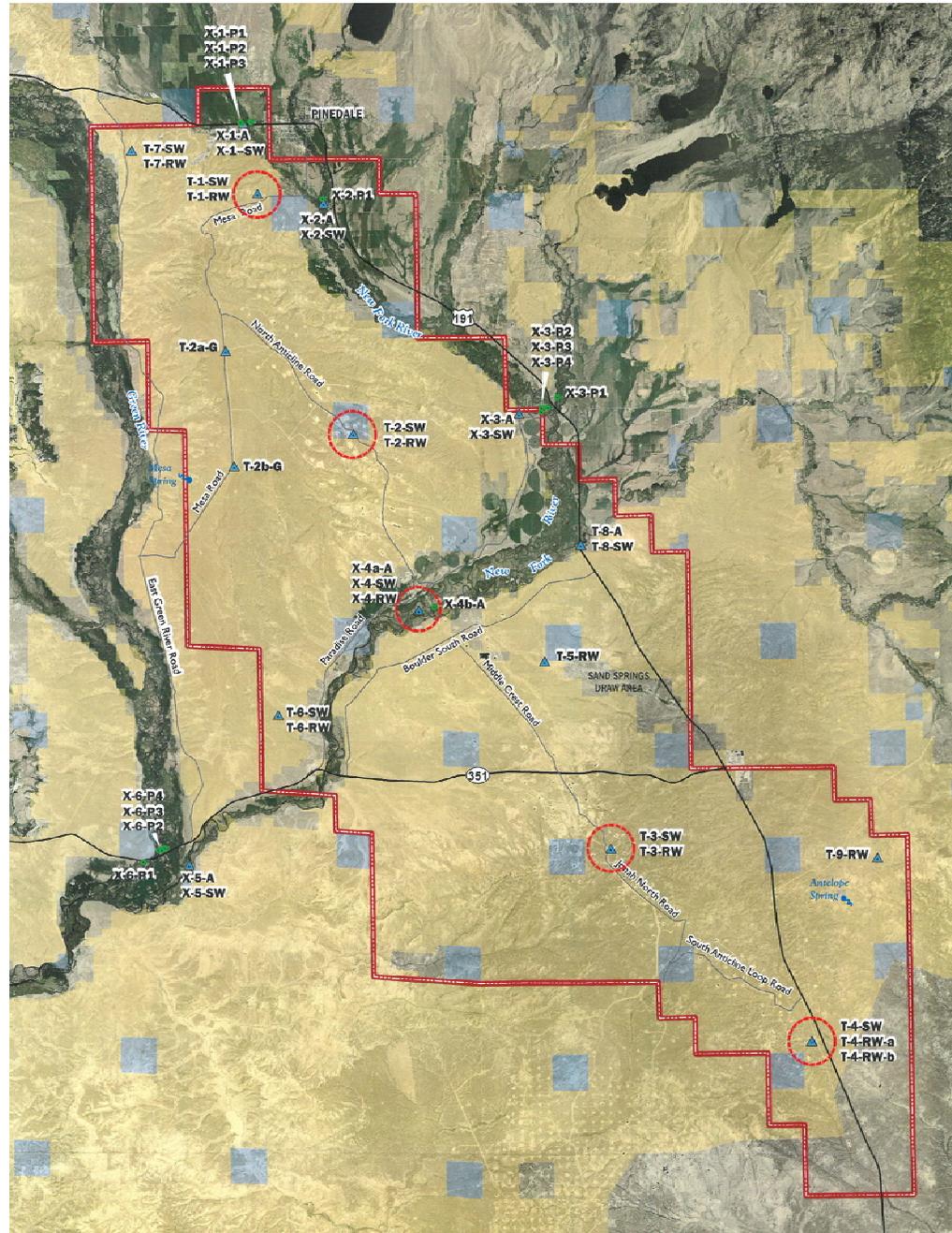
# Hydrogeologic Data Gaps Investigation Wells



# Wells (more)



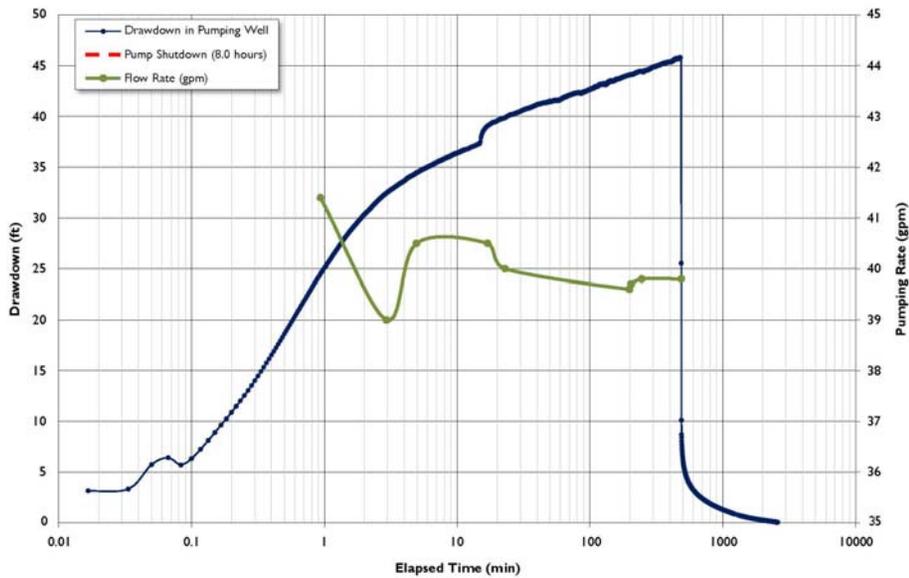
# Where



# Aquifer Testing and Sampling



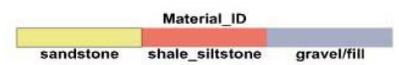
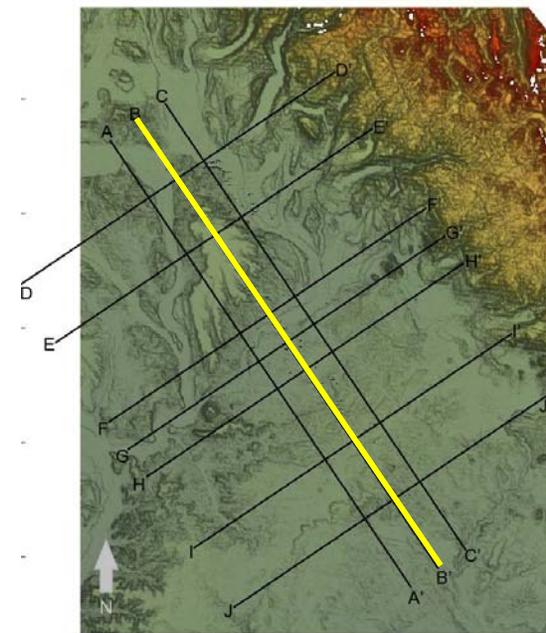
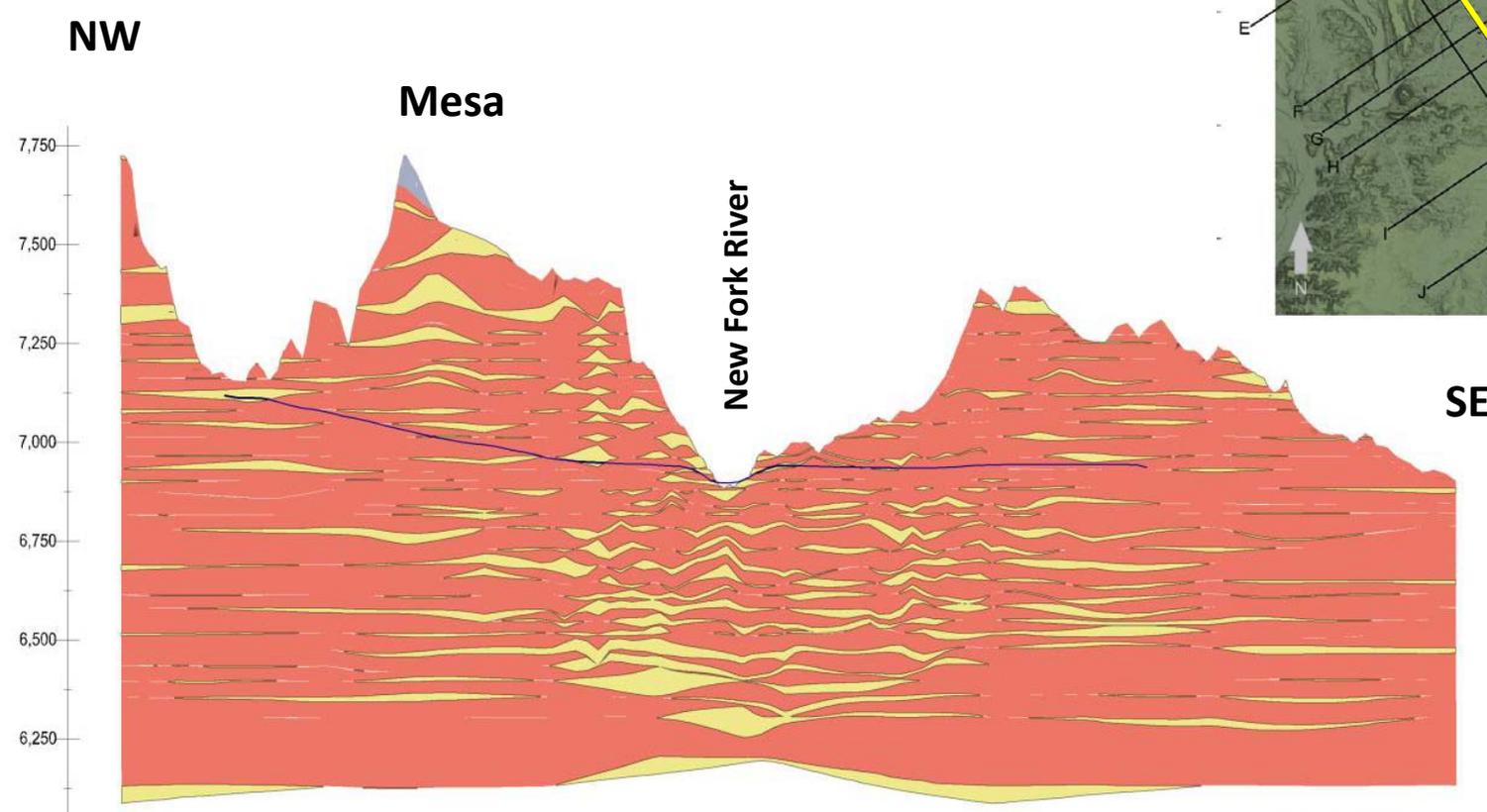
Drawdown and Pumping Rate in Pumping Well X-2-SW



# Groundwater Occurrence

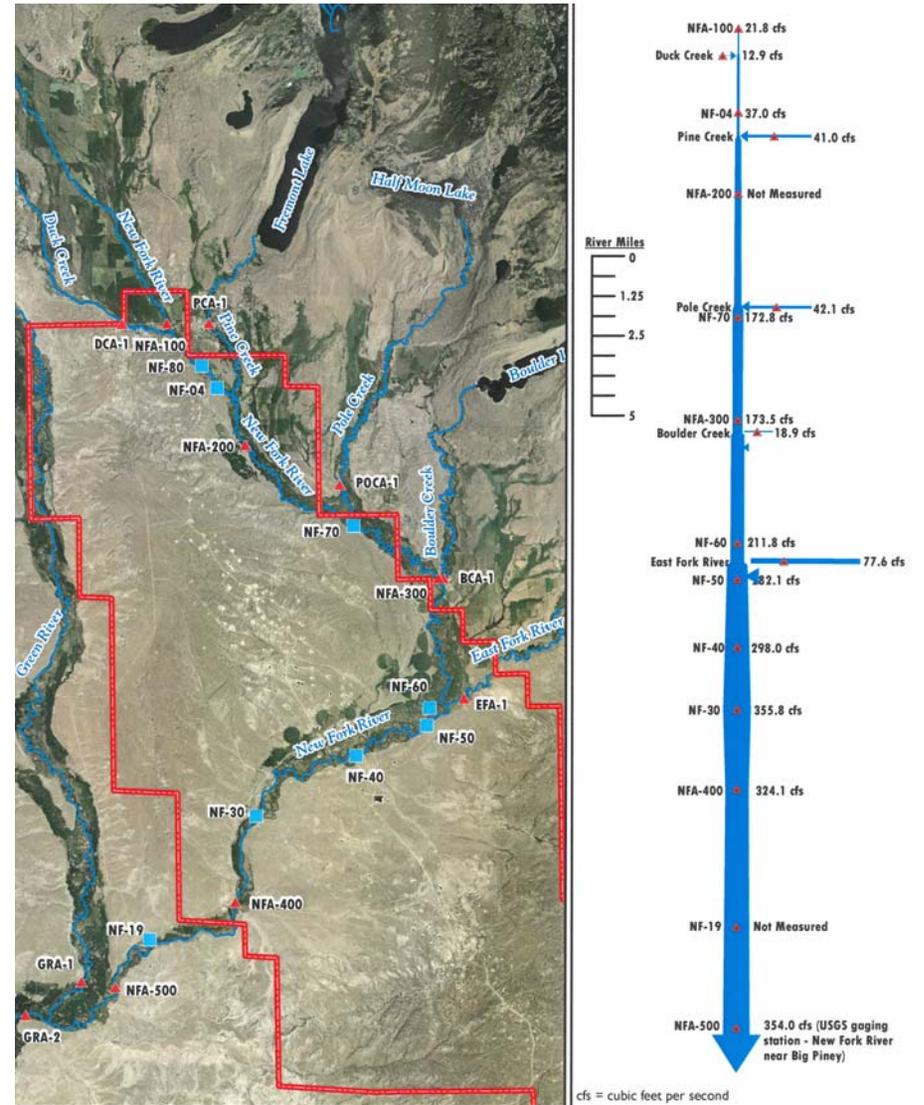
Well Type*	Total Number of Wells	Hydrogeologic Unit			
		Alluvial		Wasatch	
		Total Number	Average Depth (feet)	Total Number	Average Depth (feet)
Domestic	81	6	77	75	118
Stock	26	0	--	26	196
Industrial	156	0	--	156	645
Study	30	4**	40	24	362

# Geologic Model



B-B' = 44.6 miles

# Surface Water



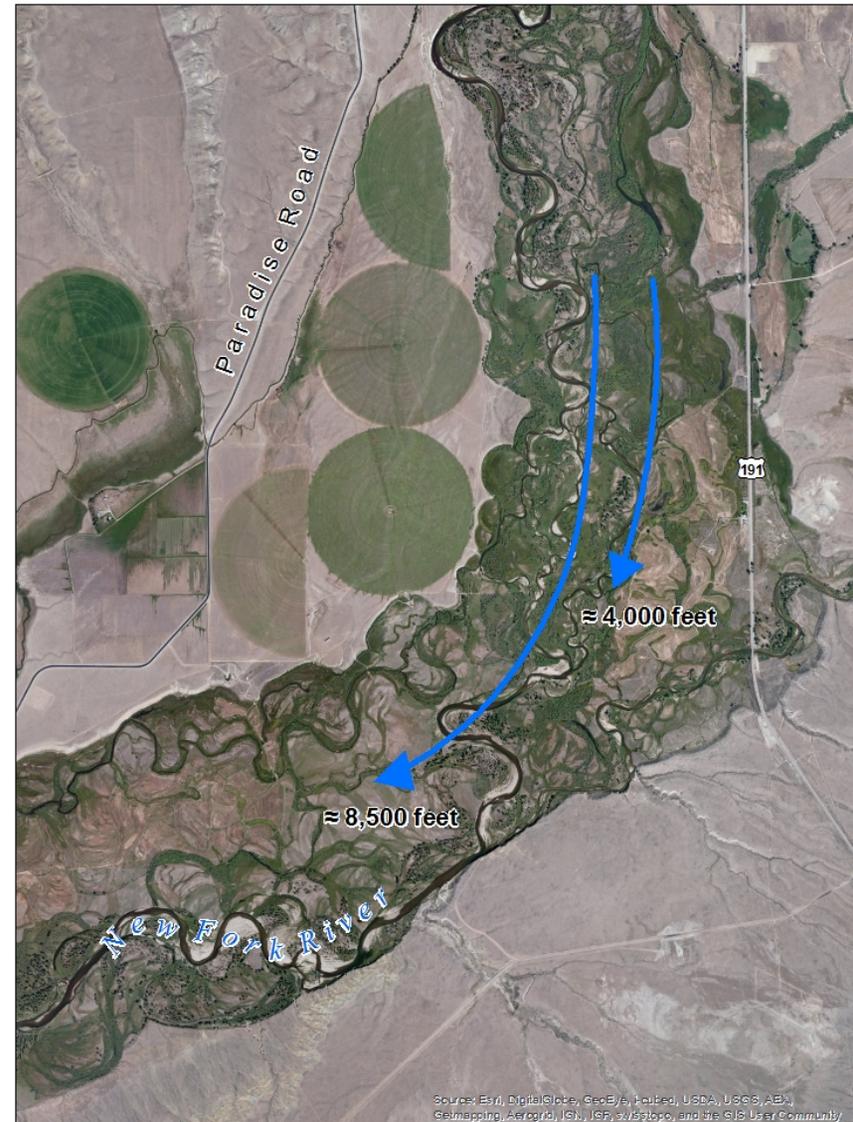


# Estimated Velocity Alluvium

## 2-Year Travel Time

Ranges ~ 0.75 to 1.5 miles

Mid-range velocity, 5 feet/day



## Estimated Velocity Wasatch

### 20-Year Travel Time

Ranges ~ 100 to 1,440 feet



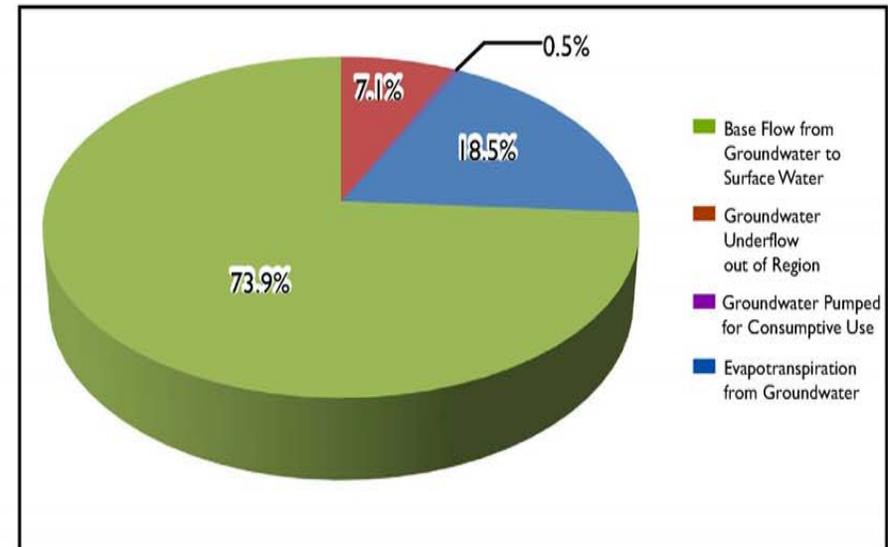
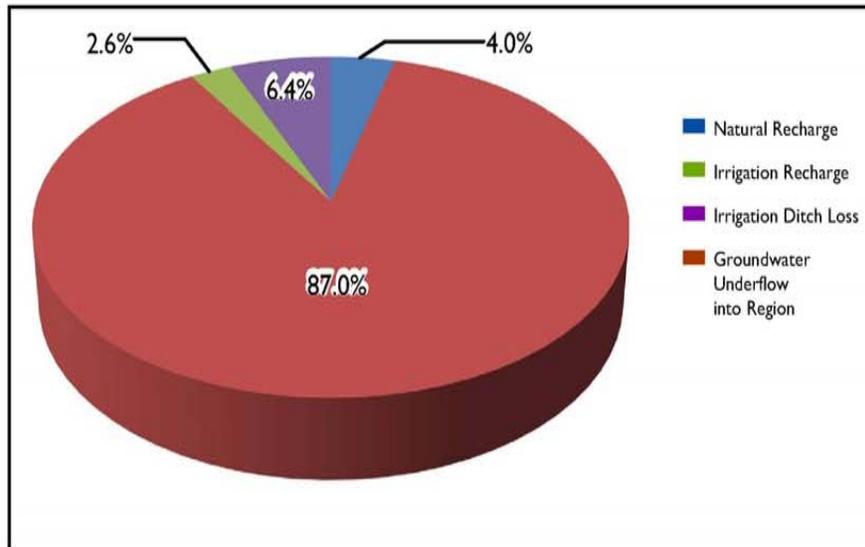
# Groundwater Balance

## Inflow

- Groundwater Underflow, in (87%)
- Irrigation Ditch Loss (6.4%)
- Precipitation (4%)
- Recharge from Irrigation (2.6%)

## Outflow

- Discharge to Rivers (73.9%)
- Evapotranspiration from GW (18.5%)
- Groundwater Underflow, out (7.1%)
- Groundwater Pumped (0.5%)



# Hydrogeologic Conceptual Model

